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Multivariable Analysis in Recovery of Mandibular Nerve Disturbance

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Objective: This study aimed to identify factors associated with the recovery of mandibular nerve disturbance and to predict the possibility of recovery tailored to individual patients. **Materials and Methods:** Patients who visited the dental hospital with symptoms of mandibular nerve disturbance from April 2015 to September 2020 were studied. Patients were divided into two groups based on treatment outcomes: recovered or non-recovered. Variables related to recovery included age, sex, onset event of the nerve disturbance, affected area, imaging findings, and treatment methods. The correlation between recovery and these variables was analyzed using the Chi-square test and Fisher's exact test. **Results:** A total of 328 patients were included in the study. Among the variables associated with recovery, the onset event of the symptom (*P*-value=0.02) and imaging findings (*P*-value=0.04) were statistically significant. Among the significant variables, the highest proportion of patients (77.78%) recovered without symptoms of onset event, while implant surgery showed the lowest recovery rate (34.25%). Regarding imaging findings, the recovery rate was highest in cases of suspected canal damage (58.82%), while no patients recovered from compression of the canal (0.00%). **Conclusion:** This study highlights the importance of large-scale data analysis and a thorough evaluation of clinical variables to understand mandibular nerve disturbances. The findings provide a basis for improving treatment strategies and reducing the impact of nerve disturbances on patients' quality of life. [J Korean Dent Sci. 2025;18(1):30-8]

Key Words: Trigeminal nerve; Mandibular nerve; Mandibular nerve injuries; Paresthesia; Anesthesia; Postoperative complications

Introduction

Mandibular nerve disturbance is characterized by abnormal sensations, such as burning, pricking, tickling, or tingling[1]. The mandibular nerve is the largest branch of the trigeminal nerve and contains both

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sensory and motor fibers[2,3]. The trigeminal nerve is the fifth of the twelve cranial nerves and branches into the ophthalmic, maxillary, and mandibular nerves. The mandibular nerve is a crucial nerve responsible for providing sensory innervation to the buccal mucosa, mandibular teeth, and the skin below the mouth.

During dental treatment, mandibular nerve disturbance is commonly caused by factors such as third molar extraction[4-6], dental implant[7,8], maxillofacial surgery[9], root canal treatment[10], and anesthesia[11]. The etiology of nerve disturbances following dental treatment, as well as the appropriate treatment methods, is not yet fully understood. Anatomical changes related to the location of the lingual and inferior alveolar nerves, variations in nerve branches, or the presence of multiple mandibular canals may contribute to nerve disturbances[12].

Mandibular nerve disturbance occurring during dental treatment may lead to temporary or permanent pain or hypersensitivity[13]. If the disturbance is temporary, sensation may return within a few days, weeks, or months, though full recovery is not always guaranteed. While most cases involve temporary nerve disturbance that typically recovers, patients may continue to experience discomfort in daily life and anxiety even after recovery[14]. Therefore, understanding the factors that contribute to the recovery of nerve disturbances is crucial.

No large-scale study has been conducted to clarify the factors associated with symptom improvement. This lack of clarity may be due to the multifactorial nature of recovery, including patients seeking treatment at multiple hospitals and undergoing various treatments. Multiple factors contribute to the recovery of mandibular nerve disturbance, and a larger patient sample is needed to accurately evaluate their influence. Most previous studies have been conducted with limited data[15] and factors[16]. To address this limitation, the present study aimed to determine whether a large cohort of patients with mandibular nerve disturbance, who visited a dental university hospital, recovered, and to identify factors and trends associated with recovery. The goal was to predict the likelihood of recovery in patients who experienced nerve disturbance.

Materials and Methods

This retrospective study was approved by the Institutional Review Board (IRB) of Yonsei University Dental Hospital (approval number: 2-2024-0090). Patient consent was waived due to the study's retrospective nature.

1. Patient selection

In this study, patients who presented to Yonsei University Dental Hospital with nerve disturbances in the mandibular region between April 2015 and September 2020 were identified using SCRAP (Severance Clinical Research Analysis Portal, version 2.0), the medical common data model at our institution. Data extraction was performed by searching for the relevant diagnosis through SCRAP, with the detailed diagnosis names specified in Table 1. The criteria for inclusion were mapped to identify patients who met the research objectives. Ultimately, all patients (n=983) were selected based on criteria such as a history of visits to the dental hospital and treatment dates between 2015 and 2020.

Table 1. Diagnosis searched based on ICD-10 code through SCRAP

Diagnosis	ICD-10 code
Trigeminal nerve disorder	G50.9
Paresthesia	R20.2
Injury, trigeminal nerve	S04.3
Injury, facial nerve	S04.5
Oral paresthesia	K13.7
Traumatic oral paresthesia	R20.2
Traumatic paresthesia	R20.2

SCRAP: Severance Clinical Research Analysis Portal.

Among the extracted patients (n=983), the following cases were excluded: first, patients with no recorded clinical history; second, patients with less than one month of follow-up; and third, patients who were transferred to another hospital during treatment. As a result, the final number of selected patients was 328 (Fig. 1). The variables considered included age, sex, affected area, onset event of the symptom, imaging findings, and treatment, all aimed at identifying factors associated with recovery. Electronic medical records (EMRs) were then thoroughly reviewed for the refined patient cohort.

2. Data analysis and variable selection

The selected patients were divided into two groups based on treatment outcomes. The recovery group consisted of patients who fully recovered or improved to the point where they experienced no inconvenience in their daily lives. The no recovery group included patients who did not recover and had some improvement in symptoms but continued to experience difficulty in their daily lives.

The following data were included as suggested variables for recovery: age, sex, onset event of the symptom, affected area, imaging findings, and treatment. The details of these variables are provided in Table 2. The variables used in this study followed the previous study of Agbeje et al. and Na et al[15,17]. Also, the variables were selected to include all analyzable variables available in the EMRs. The onset event was categorized into five types, with patients who experienced symptoms but had no specific dental intervention classified as “none”. For patients who underwent CT or CBCT examinations, imaging findings were analyzed. Imaging showing a socket and natural teeth was categorized into two groups: evident canal damage and suspected canal damage. Imaging with the presence of foreign bodies, including implant fixtures, was classified into material contact, compression, or intrusion on the mandibular canal. Based on the records, the treatment methods were categorized into four groups: medication only, surgery only, medication and surgery, and observation with no specific intervention.

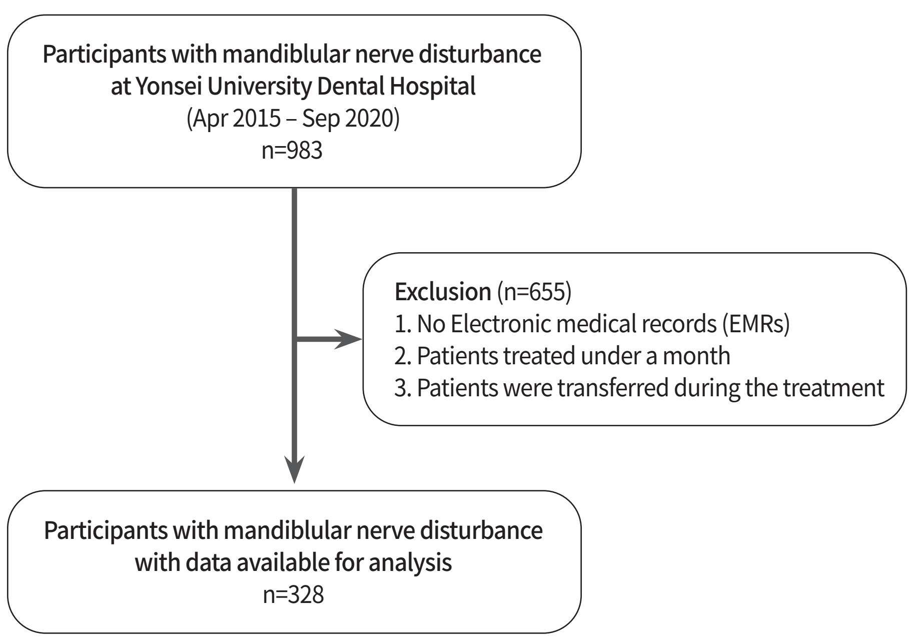

Fig. 1. Flowchart of patient selection criteria.

Table 2. Variables associated with recovery investigated

Age	10s, 20s, 30s, 40s, 50s, 60s, 70s, 80s	
Sex	Male	
	Female	
Affected area	Both	
	Left	
	Right	
Onset event of the symptom	Tooth extraction	
	Endodontic and caries treatment	
	Implant installation	
	Major operation (orthognathic surgery, tumor or cyst enucleation)	
	None	
Imaging findings in CT, CBCT	Socket state	Evident canal damage
		Canal damage suspected
	Foreign body presence	Slight contact on canal
		Compression on canal
		Intrusion into canal
	No pathologic finding	
Treatment	Medication	
	Surgery	
	Medication and surgery	
	Observation	

3. Statistical analysis

Statistical analysis was performed using SPSS (version 26.0; IBM Corp., Armonk, NY, USA). The relationship between variables and nerve disturbance recovery groups was statistically analyzed using the Chi-square test. The correlation of variables between groups was analyzed using Fisher's exact test, as more than 20% of the cells had an expected frequency of less than 5.

Results

A total of 328 patients with mandibular nerve disturbances were included in this study. Of these, 135 (41.16%) patients experienced complete or partial recovery, while 193 (58.84%) patients showed no improvement. Fig. 2 presents the distribution of recovery from mandibular nerve disturbance by age, sex, and affected area. For the three recovery factors–sex, age, and affected area–no statistically significant differences were found between mandibular nerve disturbance and recovery outcomes.

The onset event of symptom (*P*-value=0.02) and imaging findings (*P*-value=0.04) were significantly correlated with symptom recovery. Regarding the onset event, mandibular nerve disturbance occurred most frequently during implant surgery (181 patients) and showed the lowest recovery rate (34.25%). In contrast, when no specific dental event was recalled by the patient, only 9 patients were affected, but the recovery rate was the highest at 77.78% (Table 3). Imaging findings were further classified into categories: socket state (evident canal damage, suspected canal damage), foreign body presence (slight contact with canal, compression on canal, intrusion into canal), and no pathologic finding. Patients who did not undergo CT or CBCT imaging (n=26) were excluded, leaving 302

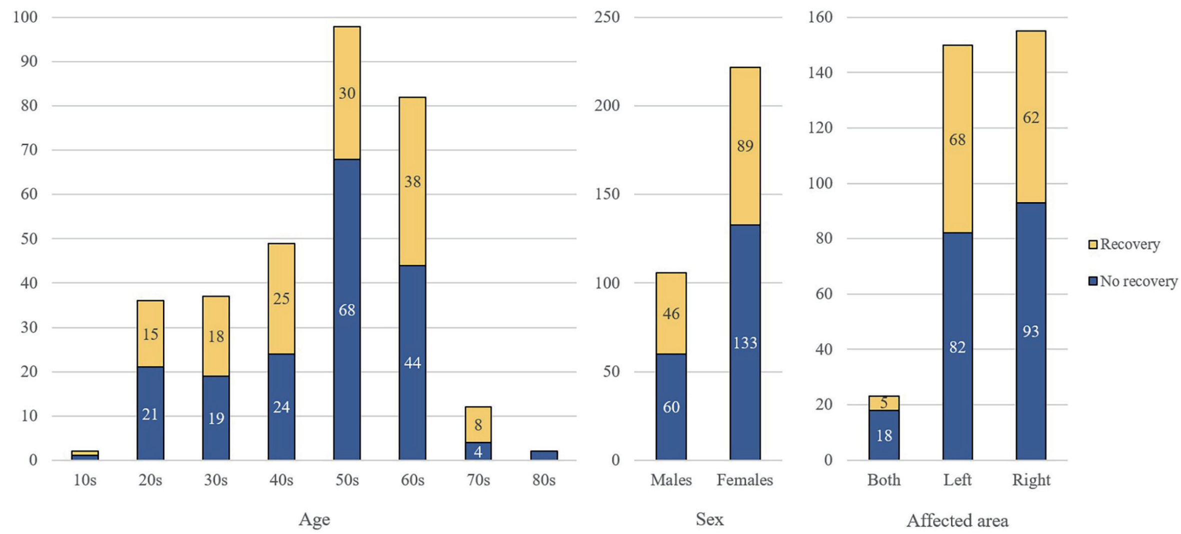

Fig. 2. Distribution of mandibular nerve disturbance recovery by age, sex, and affected area.

Table 3. Presents the distribution of recovery from mandibular nerve disturbance by onset event of symptom

	Tooth extraction	Endodontic, caries treatment	Implant installation	Major operation	None	Total	*P*-value
No recovery	47 (51.09)	9 (47.37)	119 (65.75)	16 (59.26)	2 (22.22)	193 (58.84)	0.02*
Recovery	45 (48.91)	10 (52.63)	62 (34.25)	11 (40.74)	7 (77.78)	135 (41.16)	
Total	92 (100)	19 (100)	181 (100)	27 (100)	9 (100)	328 (100)	

Values are presented as number (%).
*Statistically significant difference in the Fisher's exact test (P<0.05).

patients with available imaging findings. Table 4 shows that patients suspected nerve disturbance on imaging demonstrated the highest recovery rate at 58.82%, while no patients recovered when there was compression of nerve intrusion. Fig. 3 shows the results of the major categories of imaging findings. Among all the variables analyzed in this study, treatment method was not found to be statistically significantly associated with recovery (Table 5).

Discussion

Due to the multifactorial complexity involved in the prognosis of nerve disturbance, predicting treatment outcomes for symptom alleviation has been difficult. This study involved a thorough review of a large-scale sample population and examined various factors extracted from patients' medical records. Among the variables included in this study, the prognosis was

Table 4. Presents the distribution of recovery from mandibular nerve disturbance by imaging findings

	Socket state		Foreign body presence			No pathologic finding	Total	*P*-value
	Evident canal damage	Canal damage suspected	Slight contact on canal	Compression on canal	Intrusion into canal			
No recovery	46 (53.49)	7 (41.18)	36 (56.25)	7 (100)	11 (77.33)	72 (63.72)	179 (59.27)	0.04*
Recovery	40 (46.51)	10 (58.82)	28 (43.75)	0 (0.00)	4 (26.67)	41 (36.28)	123 (40.73)	
Total	86 (100)	17 (100)	64 (100)	7 (100)	15 (100)	113 (100)	302 (100)	

Values are presented as number (%).
*Statistically significant difference in the Fisher's exact test (*P*<0.05).

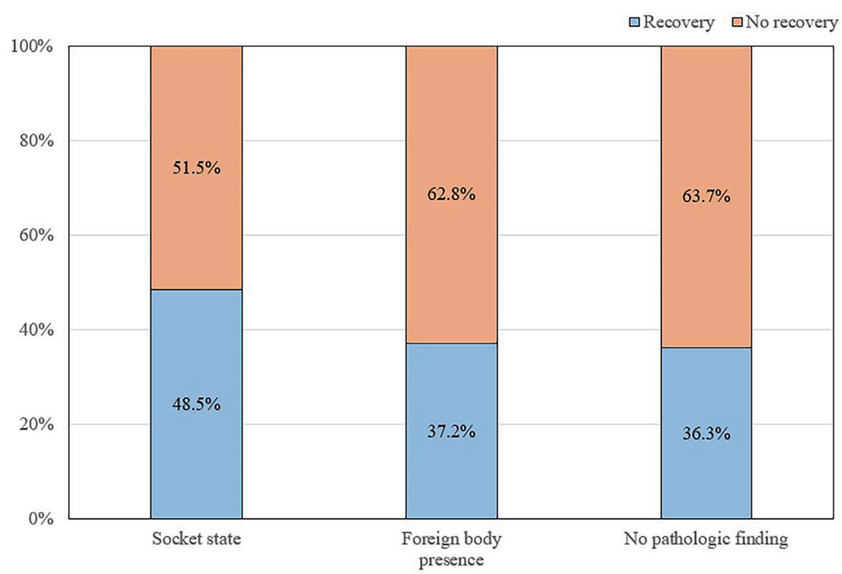

Fig. 3. Recovery and no recovery of mandibular nerve disturbance according to imaging findings.

Table 5. Presents the distribution of recovery from mandibular nerve disturbance by treatment

	Medication	Surgery	Medication and surgery	None	Total	*P*-value
No recovery	182 (58.15)	4 (57.14)	6 (85.71)	1 (100)	193 (58.8)	0.12
Recovery	131 (41.85)	3 (42.86)	1 (14.29)	0 (0.00)	135 (41.2)	
Total	313 (100)	7 (100)	7 (100)	1 (100)	328 (100)	

Values are presented as number (%).
P-values was by Chi-square test, Fishers exact test (*P*<0.05).

found to be significantly related to the onset event of symptom and imaging findings.

Among the variables related to the onset event of symptom, the recovery rate of mandibular nerve disturbance was lowest when symptoms occurred after implant surgery. Of the 328 patients, 181 (55.18%) developed mandibular nerve disturbance following implant surgery, and 119 (65.75%) of these did not recover. However, the previous studies conducted by Agbaje et al. have indicated that mandibular nerve disturbance occurred in 11% of patients (n=6) after implant placement, with 14.28% (n=3) of these patients not recovering[15]. The number of cases with non-recovery of nerve disturbance after implant surgery is similar to our study, but the number of patients who developed disturbance after implant surgery differs significantly. This large discrepancy is believed to be due to differences in clinical conditions and sample size. The number of implant surgeries performed in dental clinics in South Korea is high, which likely leads to a higher incidence of mandibular nerve disturbance due to implant surgery. Additionally, the study by Agbaje et al. included only 56 patients with nerve disturbance, which is 5.8 times fewer than the current study[15].

Imaging findings were also well-correlated with whether the symptoms recovered or not. The highest recovery rate was observed in cases with suspected canal damage (58.82%) based on imaging findings. Previous literature by Na et al. concluded that when the mandibular canal was intruded by the fixture on CT, 50% of cases showed non-recovery[17]. In our study, the sample size is larger, and the imaging classifications are more detailed, which may account for the differences in results. Moreover, mandibular nerve disturbance caused by implant placement is known to result in various types of nerve damage, including direct trauma from the fixture, nerve tissue injury from local anesthesia, heat damage from drilling, or nerve compression due to bleeding[8]. These detailed causes are difficult to assess on CT imaging, which is believed to contribute to the slight variations in the results. However, the imaging findings in the initial stage after symptom onset are considered an important factor in predicting prognosis. In addition, the current study, with more detailed imaging findings, revealed that when comparing the socket state (48.5%) to the presence of a foreign body in the images, the recovery rate is generally lower when a foreign body is present (37.2%). Therefore, if there is suspicion of a risk of nerve disturbance, it is considered that prompt follow-up treatment is necessary.

This study was conducted with a large patient sample over an extended period. This was made possible using a common data model from our institution called SCRAP. SCRAP is a system that searches and analyzes clinical information entered based on required conditions. Using data obtained from the patient's EMRs, anonymized information related to sample patients could be extracted in a time-series manner. This big data utilization model is valuable for diseases with multifactorial etiologic factors, such as nerve disturbance, which was the focus of this research. However, data extracted using SCRAP should be handled by professionals.

There are several limitations in this study. As the most patients included were referred from the dental clinics, and therefore much of the information related to the symptom relies on referral letters and patients' memories. Second, only patient data from 2015 to 2020 was used. Although many patients were screened over 6 years, the final number of participants was significantly reduced due to missing information and various exclusion criteria. In addition, there is an imbalance in the number of cases by gender and age in the patient distribution, and considering that the data was collected over a long period at one institution, it is expected that more reliable results can be obtained through additional data organization and long-term observation in follow-up studies. Furthermore, due to the small sample size of the study population, the sample size in the comparison group was insufficient, making multivariate analysis challenging. Additional research is necessary, as collecting large-scale patient data is expected to yield more accurate results regarding recovery from mandibular nerve disturbance. In future studies, we aim to collect a larger sample size to perform a more robust comparative statistical analysis, ultimately leading to stronger research findings.

Conclusion

In conclusion, understanding the multifactorial nature of mandibular nerve disturbances requires large-scale data analysis and a thorough investigation of clinical variables. The findings of this study provide a foundation for improving diagnostic and treatment strategies, with the goal of enhancing recovery rates and reducing the impact of nerve disturbances on patients' quality of life. Future research should focus on refining data collection methods and exploring additional variables to draw more robust conclusions.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Acknowledgements

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